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Creating Organizational Memory: Systematic
Management and Internal Communication
in Manufacturing Firms, 1880-1920

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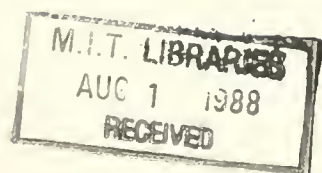
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Organizational memory has existed as long as organizations have. Knowledge of a firm's past has always been embodied in its traditions, operating routines, records, and individuals. But the nature, form, and extent of organizational memory in business enterprises in America changed radically in the late nineteenth and early twentieth centuries, driven by the emergence of the systematic management philosophy. One of its major tenets was the need to transcend individual memory in favor of organizational memory, especially in matters of internal management. Under the influence of this philosophy, managers established formal communication systems in part as a vehicle or repository for corporate memory. The communication system came to serve as an embodiment of organizational memory and evolved in ways designed to facilitate the systematic use of the past to serve the present. This paper uses both published and archival materials from the late nineteenth and early twentieth century to trace the evolution of the internal communication system as an embodiment of organizational memory.¹

Organizational memory in American firms before the mid-nineteenth century was a matter of individual knowledge and memory, simple routines, and limited records (primarily of transactions involving external parties). Most firms were managed by their owners, who carried most of the knowledge of business methods and past successes and failures in their own heads. These owner/managers were often aided by skilled artisans or foremen, who in turn carried most of the knowledge of technical methods in their heads and hands. Both owners and skilled employees applied their knowledge through simple standard procedures and through oral

orders. This knowledge could be passed on only by prolonged apprenticeship, either technical or managerial.

Written records were the other repository of firm memory. They consisted primarily of simple accounts of financial transactions and correspondence to bridge distance. While these records constituted a more permanent form of organizational memory than the inherently transient individual memory, they were limited in their extent and their usefulness for shaping the future. The journals and ledgers simply recorded debits and credits by chronology or account. Such transaction-based accounts allowed a firm to determine overall profits and to check the status of financial relations with individual suppliers, buyers, or agents. They revealed little, however, about the firm's management of costs or operations. Most correspondence concerned specific transactions, primarily with external parties. Correspondence with partners and company agents took place only when required by distance. It was fairly unsystematic and not stored so as to be readily accessible for later reference.

The factories that appeared in America beginning in the early nineteenth century did not adopt substantially different methods of preserving and transmitting organizational memory, although some of them initiated minor changes.² The factories combined several production processes in a single location, with each process or "department" run by a foreman or skilled craftsman. These foremen in turn reported to the owner or to an "agent" who managed the factory for absent owner(s). In spite of the growth of the hierarchy, however, Daniel Nelson has noted that "In many industries internal management techniques, particularly those involving

relations between the factory managers and workers, were not fundamentally different from what they had been in the craftsman's shop."³ Some factories had printed lists of rules, made up by the owners or factory managers and posted throughout the factory. These rules did not really serve as an active repository of knowledge about the workers' jobs, however, for Nelson notes that with minor exceptions, "the shop rules were largely what the forman made them."⁴ In a few cases, the separation of ownership from management at the top of the factory hierarchy led to improved accounting and reporting practices. In the Slater textile mills, for example, a primitive form of cost accounting was developed to compute the cost of labor and incidentals per yard of cloth.⁵ The plant managers reported both the financial results and this operational measure each month, enabling the owners to compare the results over time. Thus these reports recorded and preserved a measure of operational performance that was useful in assessing current performance against past performance. This innovation in organizational memory was rudimentary, but foreshadowed much that was to come. Nevertheless, most factories did not develop such measures and continued to function on the basis of individual memory and traditional, transaction-based records.⁶

SYSTEMATIC MANAGEMENT: TRANSCENDING INDIVIDUAL MEMORY

Real innovation in organizational memory awaited the emergence of the systematic management movement in the 1880s.⁷ Influenced both by improvements in the technology of production and by expanding markets, firms grew and departmentalized in the second half of the nineteenth century. Initially, however, this growth was

not accompanied by significant changes in management methods; the newly large companies were still run by the ad hoc methods of the past. The result was confusion and disorder. While the hierarchy had grown both vertically and horizontally, coordination had broken down.⁸ Production itself was still generally run by foremen or job contractors who operated autonomously on most matters.⁹ Middle and upper managers had virtually no tools for controlling what occurred on the production floor. Moreover, they lacked methods for coordinating their own actions to make the horizontal flow of materials through the production process efficient. The profits expected from expansion often failed to materialize.

In response to these problems, managers, often engineers by training, began a "search for order and integration" that Joseph Litterer has called "systematic management."¹⁰ In the 1870s a literature on management theory and technique began to appear, written by such men as J. Slater Lewis, Henry Metcalf, H. L. Arnold, Alexander Hamilton Church, H.M. Norris, and John Tregoin. Litterer has described the systematic management movement as an attempt to "put 'method' into the management of firms to avoid confusion and waste, to promote co-ordination and to re-establish effective control by top management."¹¹ Method or system, as it was most commonly termed, was necessary for achieving efficiency and profitability in the growing firms. These "systematizers" shared a common belief that new and more systematic methods needed to replace "the old slipshod way of our forefathers."¹²

The broad movement that emerged from this literature over the next several decades, of which the better known scientific management of Frederick W. Taylor and his followers was a part, was

somewhat amorphous, but it was grounded in a few basic principles. One of these was, as Mariann Jelinek has stated it, "a continuing attempt to transcend dependence upon the skills, memory, or capacity of any single individual" -- that is, an attempt to transcend individual memory in favor of organizational memory.¹³ As long as knowledge of shop floor and administrative processes resided only in individuals, the comprehensive overview necessary to achieve efficient coordination was impossible. Moreover, the loss of an individual meant the loss of important company knowledge.

Thus the knowledge and skills of individuals from the lowliest worker to the head of the firm needed to exist independently of that individual. On the lowest level of the hierarchy, Frederick Taylor noted that this required "The deliberate gathering in on the part of those on management's side of all the great mass of traditional knowledge, which in the past has been in the heads of the workmen, and in the physical skill and knack of the workman, which he has acquired through years of experience."¹⁴ Most of the systematizers of the 1880s and 1890s were more concerned, however, with capturing the knowledge of foremen, supervisors, and managers. H. L. Arnold, for example, discussed the growth of the hierarchy and the corresponding processes by which each manager became "the depository of a mass of unrecorded information not possessed" by those at higher levels.¹⁵ Thus the firm "becomes every day more and more an assemblage of independent powers," protecting their knowledge from others and failing to achieve efficient coordination. Alexander Hamilton Church was concerned with the highest level: "How many concerns languish when the care of their founder is withdrawn and why? Simply because he cannot transfer the multitudinous details of

organization from his memory to that of a successor."¹⁶

The solution to these problems lay, systematizers such as Henry Metcalfe argued, in recording and transmitting knowledge in writing:

Now, administration without records is like music without notes--by ear. Good as far as it goes--which is but a little way--it bequethes nothing to the future. Except in the very rudest industries, carried on as if from hand to mouth, all recognize that the present must prepare for the demands of the future, and hence records, more or less elaborate, are kept.¹⁷

Written records and communications documented both procedures and outcomes. They recorded and transmitted existing knowledge, as well as providing the data on the basis of which further analysis could be made. As Church stated, "Under rational management the accumulation of experience and its systematic use and application, form the first fighting line."¹⁸

The desire to transcend the individual and establish more extensive organizational memory was an important factor in the explosion of internal communication within firms over the next few decades. While previously documentation had been considered necessary primarily in transactions with external parties, now the internal workings of the company became a subject for documentation. Policies and procedures were documented and communicated via downward communication; operating information was documented and communicated up the hierarchy via records and reports; internal correspondence documented coordination and friction. Repositories for storing this organizational memory accessibly became a focus of attention. I will trace the outlines of these developments, using

examples from the archival records of the Scovill Manufacturing Company, a manufacturer of brass products, and Du Pont, which manufactured explosives, as well as from published literature of the period.

Documenting Policies and Procedures

Communicating policies, procedures, and orders in writing made them available for future reference. One systematizer stated his belief in written conveyance of orders and his reasons for that belief as follows:

As to the form that an order should take, the only satisfactory form is the written order. . . .If the request is in writing neither [the sender nor the recipient] is obliged to depend on his memory. The written order removes all chance of dispute as to its conditions, neither can there be a question of the authority of an order which bears the signature of the head of a department. . . . Another great advantage of the written order is that the head of a department may keep copies and follow-up each order to see that it is properly executed.¹⁹

The written order, whether to an individual or to the whole company, became part of organizational memory rather than just individual memory. It was then available for whatever future needs might arise.

While the need to document rules seems obvious today, as late as 1887 one of Scovill's senior executives stated his philosophy against it:

We have never had any shop rules printed. There is a general understanding that ten hours constitute a day's work and that the hands are expected to do a day's work if they get a day's pay. Each department is under the direction of a foreman, in whom we trust and who sees that the hands are industrious and attend to their business. If they do not do it, he sends them off and gets others. . . . We do not think printed rules amount to anything unless there is somebody around constantly to enforce them and if such a person is around printed forms can be dispensed with.²⁰

Only when the systematic management philosophy found its way into the company's management in the early twentieth century did this policy change. By 1905 a member of a new generation of management at the company, J. H. Goss, presented a series of recommendations for overcoming inefficiencies by systematizing a particular function in the company.²¹ In this report, one of his recommendations was to record policies and issue written regulations so that "there could be no chance for misunderstanding due to changes of one sort or another." From this time on, an ever increasing flow of written orders, policies, and procedures were issued from various levels of management.

Du Pont had a posted rule against matches (a critical safety rule in an explosives plant), but it issued no circular letters documenting other rules and policies before it was reorganized in 1902.²² Even communication with its many agents throughout the

country was handled via individual letters dealing with specific cases.²³ Only agency contracts were standardized and printed up in a form intended to be relatively permanent. However, the establishment of an organizational memory of rules and procedures began earlier at the Repauno Chemical Company, which was founded in 1880 by one of the du Ponts who broke off from the main company, and which would become central to the Du Pont Company as it was reconfigured after 1902.²⁴ Lamot du Pont and the rest of the executives at Repauno were early followers (in some cases even leaders) of the systematic management movement.²⁵ They issued circular letters to agents by at least 1895, both standardizing procedures and documenting them for future reference.²⁶

Thus after Du Pont was reorganized in 1902, the High Explosives Operating Department (HEOD) built around the old Repauno already had a tradition of establishing a corporate memory of policies and procedures by issuing bulletins and circular letters. The department used such communications heavily in systematizing activities at the many dynamite plants that Du Pont bought up in the wake of the reorganization. The role of these circulars in documenting policies for future reference as well as immediate use was reinforced by developments in their format and storage. Beginning in 1906 and 1907, HEOD headquarters numbered each document and indicated a file number under which it was to be filed in their files.²⁷ Within a few years, methods of filing the circulars at each of the plants were mandated, as well, "in order that we may be sure that all plants have a complete and permanent file of circular letters."²⁸ Even the methods of indexing that file were prescribed, to "allow easy and quick reference to any particular letter that is

desired."²⁹ In the reorganized and systematized Du Pont of the early twentieth century, establishing accessible and relatively permanent organizational memory was considered important.

However complete the storage system for circular letters, such communications were issued as needed and generally dealt with a specific topic. Thus they were, by nature, fragmentary. Eventually they were supplemented by a more comprehensive embodiment of organizational memory: the manual.³⁰ Manuals brought together in one place all of the rules and procedures for a firm or department. They were generally, as one systematizer noted, "planned to be permanent and to be in such complete form that a new man in the department, after reading the instructions would have a thorough understanding of the duties and responsibilities of it."³¹ Furthermore, by compiling all of the rules and procedures in a single place, the manual made it easier to analyze and update them, thus fulfilling other goals of systematic management. These manuals could be in bound or loose leaf form.³² The former seemed more permanent, but had to be replaced periodically as firms changed. The latter, which were considered more modern, created a more dynamic organizational memory that could be updated as needed (much as individual memory might be).

In Du Pont's progressive HEOD, which had the benefit of a long history of circular letters within Repauno, a manual appeared early in the twentieth century. By at least 1907, about the same time that circular letters came to be numbered, a loose leaf manual called HOW began to be issued.³³ Scovill only issued its first manuals in 1918.³⁴ Both employees' and foremen's manuals were issued by Scovill's newly formed Industrial Service Department.

While the bound employees' manuals covered all company workers, the looseleaf foremen's manuals were made up as needed for a given department. These manuals, then, took the establishment of organizational memory of policies and procedures a step further than did circular letters by attempting to be comprehensive.

Documenting Operating Information

If downward written communication recorded policies and procedures once retained only by individual memory, upward reporting recorded operating results for future reference. One of the principal tenets of systematic management was the need for each level of management to analyze and compare the performance of lower levels with the ultimate aim of achieving greater efficiency. Routine reporting systems were established to pull various types of information up the hierarchy for use in managerial evaluation and decision making. Operating information once known only by foremen and lower level managers was now recorded, frequently in quantitative form, and reported to higher levels. As Alexander Hamilton Church put it, "The object of the commercial, or, as it might also be termed, the administrative organization scheme, should be to collect knowledge of what is going forward, not merely qualitatively, but quantitatively: It should also provide the means of regulating as well as the means of recording."^{3 5} While this paper is not concerned with the analytic uses to which the information was put when it reached the top, clearly any analysis

required collecting and preserving information in consistent form for later comparison.

Before the early twentieth century, records and reports at Scovill were limited and almost exclusively financial. At the same point that circular letters began to document policies and procedures, records and reports began to proliferate, as well. For example, beginning in 1907 J. H. Goss instituted various records and tabular reports on costs in the department he headed.³⁶ At the end of each year a summary was compiled for each cost category. The comparable figures for the previous year were provided in the adjacent column for comparison. Such comparisons could only be made, of course, when such figures were routinely stored as part of the organizational memory. When J. H. Goss was promoted to general superintendent of manufacturing in a few years, he initiated similar cost reports for the entire manufacturing function. Building an organizational memory of operating data allowed types of analysis never before possible.

By the end of the first world war, records and reports were widespread in the firm; in fact, a list of reports routinely sent to the general superintendent's office in 1919 included over 200 items.³⁷ The reporting system had grown to such an extent that it needed to be rationalized. In 1918 a Statistics Office was created with that goal. In Statistician E. H. Davis's initial report on his office's goals, he described the process by which records were made at the production level, transcribed in more permanent form, then summarized into reports, eventually building "a sort of numerical history."³⁸ This general process was appropriate, he argued, but "The problem of the present day is, briefly, for a more

reliable and comprehensive application of this traditional process." As a first stage in rationalizing the process, "the statistical office will become a clearing house of reference as to what current records actually exist, and where they are available." His ultimate goal was to make the office the actual "depository of carbon copies of many such reports or records, as they are made; and thus a general body of statistical data covering the entire plant will be accumulated." This office was to be the embodiment of statistical organizational memory.

In reporting, as in downward communication of policy and procedures, Repauno was well ahead of Du Pont itself before the 1902 change in management. While most Du Pont sales agents had no reporting requirements beyond their quarterly accounts, for example, Repauno sales agents were required to submit monthly credit reports and almost daily trade reports.³⁹ In the post-1902 Du Pont, the Sales Department adopted and elaborated on Repauno's reporting system.⁴⁰ By the second decade of the twentieth century, the department had organized a Sales Record Division concerned exclusively with maintaining "all information concerning the smallest unit (customer) in one place for Quick reference -- and Follow-up of trade and salesmen." This card reference system was essentially a data base of sales information -- a constantly updated, readily accessible organizational memory.

By 1907, HEOD headquarters demanded yearly, monthly, weekly, and even daily reports from each plant. These reports, a representative of headquarters explained to plant superintendents at a meeting, were both "for the Superintendent's guidance" in running the plant, and "for the Main Office records."⁴¹ In the latter

function, they served as the basis for the many comparisons headquarters made of the various dynamite plants.⁴² The superintendents often complained about the number of reports demanded of them, no doubt both because time was required to make out such reports and because the organizational memory these reports created enabled headquarters to evaluate their performance more specifically. Their resentment was expressed, for example, in the following satiric item in a humorous newsletter created for one superintendents' meeting:

The Chemical Division [of HEOD] is just about to distribute new forms known as the Hourly Operating Reports. Every plant operation is covered from the Nitration Process to tool sharpening and belt lacing. Each form contains about 600 spaces to be filled in and the reports are to be forwarded to the Wilmington Office hourly by special messenger, where they will be carefully filed for the benefit of Posterity.⁴³

Far from serving just posterity, however, these reports helped headquarters analyze and compare performance between plants and over time. Ultimately, the organizational memory was the basis for improvements in efficiency.

In Scovill, Du Pont, and many other systematized companies of the early twentieth century, records and reports had evolved as a mechanism for transcending the individual memory as well as for regaining control over the production process. Their contribution to organizational memory was increasingly in numerical form, allowing new kinds of analysis and progressive improvements on the basis of this analysis.

Documenting Friction

While the advocates of systematic management were concerned primarily with maintaining an organizational memory concerning policies and procedures, on the one hand, and operating data, on the other, the value placed on documentation for future reference often came to be extended to other types of vertical and lateral communication, as well. For example, in describing types of written communication that might have to be handled, one text on correspondence filing noted this category:

Of considerable importance in every large organization is the interdepartment correspondence - the notes from one department head to another. Every department head finds it necessary at times to request information from other departments. Even with an intercommunicating telephone system with which every large office and plant should be equipped, many of these requests are of a nature that, to guard against misunderstandings, demand written communications.⁴⁴

A text in business English went even further, extending the principle of documentation for the record to all internal communication: "It is necessary in business that orders should be definitely given, questions specifically and intelligently asked and answered, and that some record of all communications be kept."⁴⁵ In practice, internal correspondence other than circular letters and reports seemed to occur most often when friction was present between the correspondents, and each side wanted to document its position for later reference.

At Scovill, for example, friction between the Casting Department and the Research Department generated considerable

documentary correspondence. The casting bosses or foremen used to be the sole repository of the secrets of casting, but in the early twentieth century the Research Department was established to study and record various alloys and casting methods. Predictably, there was tension between the Casting foreman, W.H. Monagan, and the Research Department. The largest component of Monagan's correspondence documented his ongoing battles with that department, as in this note:

The second paragraph of your letter of March 14th reads as follows:

"It is my understanding that you will suspend weekly reports, and that you will not require analyses of the metal, at least, for some time."

I would like to go down on record as saying that if at any time I wish to have any part of the program, which has been agreed upon by the Research Committee and myself, suspended I will notify the Research Committee.⁴⁶

Clearly, this note was written less to communicate his view than to record it for later reference.

Similarly, much of the surviving early twentieth century correspondence within Du Pont's research unit, called the Experimental Station, documented points of friction. The relatively large and independent Ballistics Division, which had originally been part of a different department, frequently recorded its objections to various policies in writing. For example, the division head wrote a series of memoranda to the director of the Experimental Station, all dated the same day, complaining about the system for assigning overhead costs. In the final item of this series he

wrote:

The system by which we have a separate charge known as E-2-Ballistic, and no corresponding separate charge for the other Divisions, is unjust and unsatisfactory.

We have just sent you a number of memorandums, showing, in detail, how this has worked out for specific charges. One remedy for this situation is to abolish the account E-2-Ballistic.

Please advise the reasons, if any, why this state of affairs should continue.⁴⁷

Here organizational memory is being used as a weapon in internal power struggles, a use very familiar to us in the 1980s.

Making Organizational Memory Accessible

In these political uses of organizational memory as well as in the recording of policies and of operational data, storage of the documents played an important role in their functionality. Only if they could be referred to readily could they fulfill their purpose. Nineteenth century systems of storage, including bound books, pigeonholes, and letter boxes, were old and inconvenient. They separated outgoing from incoming items and were organized in different ways. These old systems came under great pressure both from increased external correspondence and from the evolution of internal documentation. Around the turn of the century, they gave way to the vertical files we still use today.⁴⁸ The importance accorded to this development was evidenced by the large number of texts on indexing and filing issued at that time.⁴⁹ As one such text explained, "It will already have become evident that it is

impossible to sever the problem of finding a good practicable filing system from the whole problem of business organization."⁵⁰

Organizational memory was an important element of systematic management, and filing documents accessibly was critical to maintaining an efficient organizational memory.

Functional filing systems were adopted in the early twentieth century in both Scovill and Du Pont. An exchange between Scovill's New York store and its headquarters that took place in 1913, just before vertical filing was adopted, illustrated the problems with the old systems: "Replying to yours of the 24th regarding terms to Jos. L. Porter & Co., we are sorry that our record for 1908 is quite as inaccessible as yours seem to be, and, unless you consider the matter of enough importance, you will let the matter pass."⁵¹ One week later, on the first day of 1914, the company instituted its new system of vertical filing.⁵² The new files were organized by subject, rather than by chronology or source. This system created a much more functional organizational memory, enabling all the firm's records and correspondence (internal and external) on a given subject to be stored and retrieved together.

New filing systems had a particularly important effect on the internal correspondence that documented friction. While both downward communication of policy and procedures and upward reporting of operational data from before the advent of the files have survived, no lateral or other general correspondence documenting friction has survived from the earlier period. Whether the absence of such correspondence indicates that it was not written or that it was not saved is not clear, but certainly putting something in writing primarily for the record was more sensible when it could be

referred to readily in the future. The vertical files that were created beginning in 1914 are full of such correspondence, as well as of circular letters and reports.⁵³

Du Pont followed Repauno's lead in this matter as in others. Repauno had adopted vertical filing by 1901, before the 1902 reorganization that brought it into the company.⁵⁴ We have already seen the importance that the HEOD placed on accessible filing of circular letters and bulletins at the various plants and of statistical records and reports in the Statistics Office. The filing system also played an important role in more general internal correspondence. One of the points of friction between the Ballistics Division and the Experimental Station, of which it was a part, was the Ballistics Division's insistence on maintaining separate files. When it became part of the Station, the Station director said that the separate files must be phased out, stating, "since the consolidation with the Experimental Station, it is of course the wrong principle to run a separate line of files."⁵⁵ Ballistics succeeded in maintaining its separate files, however, until 1919, when a new filing system was established for the entire Station.⁵⁶ This division clearly felt that it was important to maintain its own organizational memory, rather than folding it into the Station's. The existence of its own repository may also have encouraged that division to document points of friction for future reference. It may be significant that the vast majority of general correspondence in the main Station files is to and from the Ballistics Division.

With the enormous number of records and reports being created in the Experimental Station, the HEOD, the Sales Department, and

elsewhere, space and long-term storage soon became a concern. By at least 1907, Du Pont had established a records center called the Hall of Records to serve as "a storage place for books, records and valuable papers which have ceased to be of active use but which, for good reasons, it is desirable to keep."⁵⁷ Thus while some outdated records were disposed of, others were stored to provide a permanent (or at least very long term) corporate memory.

CREATING ORGANIZATIONAL MEMORY

During the period from 1880 to 1920, individual memory was increasingly transcended in favor of organizational memory in manufacturing firms. Transactions and communications with the external world had long been documented for later reference if needed. Driven by growth and the spread of systematic management, firms now documented internal knowledge just as scrupulously. The impulse towards relatively permanent documentation of policies and procedures, operating data, and inter- and intradepartmental friction transformed internal record-keeping and communication. The files, rather than any individual, became the repository for the firm's knowledge about itself. The nature (and consequently uses) as well as the amount of recorded knowledge changed.

Recording policies and procedures allowed them to be analyzed as a whole and changed as needed for better efficiency and control. Scholars such as David Noble have seen this process as an aggressive attempt by managers to oppress the working class: "As managers in industry, engineers now undertook to expropriate and systematize the intelligence of production, to place it in the hands and handbooks of management, and to use it to reorganize the production process

for maximum output and profit."⁵⁸ This conversion of individual knowledge into firm knowledge, however, was not limited to the workers; it occurred in the managerial ranks, as well. And for all its potential for abuse, the process was an important one in converting small family businesses dependent on the founder into ongoing enterprises in which actions were systematically coordinated for maximum efficiency. Now the firm could continue even as individuals came and went.

Documenting operational information in records and reports created a data base of information susceptible to analysis. Using such data, managers could help identify more and less efficient processes and individuals. Decisions could now be based on statistical facts rather than gut feel. This abstraction of reality also had its potential for abuse, since numbers do not reflect all the human concerns. Nevertheless, it gave management at each level a tool for understanding and controlling what went on at lower levels. It helped reintegrate the firm vertically, as systematizers desired. Documenting friction was less integral to systematic management and to efficiency, but it served a human need, as well.

By 1920, both the communication system and the nature of organizational memory had been transformed. Under the impetus of systematic management, individual memory and skills had been transcended in favor of an enduring organizational memory. This organizational memory was embodied in the files of records, reports, manuals, and memos.

¹This paper explores one aspect of the evolution of internal communication as I have traced it in Control through Communication in American Firms, 1850-1920, to be published by Johns Hopkins University Press in 1989.

²Descriptions of such factories are contained in Barbara M. Tucker, "The Merchant, the Manufacturer, and the Factory Manager: The Case of Samuel Slater," Business History Review 55 (Autumn 1981), 297-313; Alfred D. Chandler, Jr., The Visible Hand: The Managerial Revolution in American Business (Cambridge, MA: The Belknap Press of Harvard University Press, 1977), pp. 67-72; and Daniel Nelson, Managers and Workers: Origins of the New Factory System in the United States, 1880-1920 (Madison: University of Wisconsin Press, 19785), pp. 3-4.

³Nelson, pp. 3-4.

⁴Nelson, p. 44.

⁵Tucker, 308-309.

⁶Chandler, pp. 70-72.

⁷Many of the principles of systematic management, including those affecting organizational memory, were anticipated by the railroads in the 1840s, 1850s, and 1860s, as I have shown in Control through Communication. Because these developments did not carry over directly to the manufacturing sector and because my space is limited, I will not discuss them here.

⁸Josheph Litterer, "Systematic Management: Design for Organizational Recoupling in American Manufacturing Firms," Business History Review 27 (Winter, 1963), 372-373.

⁹Nelson, Managers and Workers, Chapter 3, "The Foreman's Empire."

¹⁰Joseph Litter, "Systematic Management: The Search for Order and Integration," Business History Review 35 (Winter 1961), 461-476). Other discussions of systematic management appear in Litterer, "Design for Organizational Recoupling," cited above; Litterer, "Alexander Hamilton Church and the Development of Modern Management," Business History Review 35 (Summer 1961), 211-225; Marian Jelinek, "Toward Systematic Management: Alexander Hamilton Church," Business History Review 54 (Spring 1980), 63-79; Chandler, The Visible Hand, pp. 272-281; Nelson, Managers and Workers, Chapter 4; and Nelson, "Scientific Management, Systematic management, and Labor, 1880-1915," Business History Review 48 (Winter, 1974), 479-500.

¹¹Litterer, "Design for Organizational Recoupling," 370.

¹²H.M. Norris, "Shop System," Iron Age, 54 (November 1, 1894), 746, as quoted in Litterer, "The Search for Order and Integration," 473.

¹³Jelinek, p. 64.

¹⁴Taylor, Scientific Management, as quoted in David F. Noble, America by Design: Science, Technology, and the Rise of Corporate Capitalism (NY: Oxford University Press, 1977), p. 265.

¹⁵Henry Roland (H.L. Arnold), "An Effective System of Finding and Keeping Shop Costs. I. Simplicity and Sufficiency of the Job Ticket Method," Engineering Magazine 15 (1898), 77, as quoted in Litterer, "The Search for Order and Integration," 472.

¹⁶ Church, "The Meaning of Commercial Organization," Engineering Magazine 20 (1900), 395, as quoted in Litterer, "The Search for Order and Integration," 471.

¹⁷ Henry Metcalf, "The Shop-Order System of Accounts," Transactions of the American Society of Mechanical Engineers 7 (May 1886 meeting), 440.

¹⁸ Alexander Hamilton Church, "Practical Principles of Rational management," Engineering Magazine 45 (1913), 675, as quoted in Litterer, "Alexander Hamilton Church," 223.

¹⁹ James B. Griffith, ed. Systematizing, 2 Vols., published by The International Accountants' Society, Inc. (Detroit: The Book-keeper Press, 1905, pp. 19-20.

²⁰ Quoted in Philip W. Bishop, unpublished manuscript history of Scovill (ca. 1952), Scovill archives, Baker Library, Harvard Business School, p. 205. Manuscript cited with permission of Mr. Bishop.

²¹ 22 February 1905, J.H. Goss, "Report Made to the General Manager on Timekeeping in the Departments," in "Notices, 1905-1907, Case 34, Scovill II, Baker Library, Harvard Business School. (All further items designated Scovill I and Scovill II are from the two groups of Scovill records stored in Baker Library.)

²² The match rule may be found in Accession 504, Series A, Box #20, Hagley Museum and Library, Wilmington, Delaware. Du Pont's 1902 reorganization is described in detail in Alfred D. Chandler, Jr. and Stephen Salsbury, Pierre S. du Pont and the Making of the Modern Corporation (NY: Harper & Row, Publishers, 1971), Part I.

²³ See, for example, the correspondence with Chicago agent E.S. Rice, Accession 500, Series I, Part I, Series B, Boxes 307-310, in

the Du Pont collection, Hagley Museum and Library, Wilmington, Delaware. (Hereafter citations from Accession 500 of Du Pont materials in Hagley Museum and Library will be cited as Du Pont 500/I/I/B/#307-310.)

²⁴For the story of Repauno Chemical Company's birth and its relationship to Du Pont, see Norman B. Wilkinson, Lammot du Pont and the American Explosives Industry, 1850-1884 (University Press of Virginia, 1984), pp. 231-247.

²⁵Norman B. Wilkinson, "In Anticipation of Frederick W. Taylor: A Study of Work by Lammot du Pont, 1872," Technology and Culture 6 (Spring 1965), 208-221; and Ernest Dale and Charles Meloy, "Hamilton MacFarland Barksdale and the Du Pont Contributions to Systematic Management," Business History Review 36 (Summer 1962), 131-144.

²⁶While none of these circular letters have survived, they are mentioned in 20 February 1895, J. Amory Haskell's assistant to Haskell, Du Pont 500/II/2/#991.

²⁷See Du Pont 500/II/2/#550-551, 553-554.

²⁸HEOD Circular #572, 8 July 1910, Du Pont 500/II/2/#550.

²⁹I have more thoroughly explored the role of filing in the evolution of internal communication in "From Press Book and Pigeonhole to Vertical Filing: Revolution in Storage and Access Systems for Correspondence," Journal of Business Communication 19 (Summer 1982), 5-26; as well as in Control through Communication.

³⁰While in the railroads, manuals preceded circular letters, in manufacturing businesses, the order was reversed. See Control through Communication, Chapter 3.

³¹ H.A. Russell, "Keeping Track of Work in Process," Iron Age 98 (July 6, 1916), 8.

³² For discussion of the form and content of manuals, see, for example, Lee Galloway, Organization and Management, Vol. II, Modern Business (NY: Alexander Hamilton Institute, 1914), pp. 325-6.

³³ The first reference to HOW in the surviving records is in the minutes of the 1907 plant superintendent's meeting, HEOD Meeting #27, June 19-21, 1907, Longwood Manuscripts Group 10, Series A, File 418 Box #13, Hagley Museum and Library (hereafter LMss 10/A/418/#13).

³⁴ 'Employees' and foremen's manuals are in Case 34, Scovill II.

³⁵ Church, "The Meaning of Commercial Organization," Engineering Magazine 20 (1900), 391, as quoted in Litterer, "Alexander Hamilton Church," 213.

³⁶ Beginning in 1907, J.H. Goss had tabular Cost Analysis Sheets made out for the Burner Department each month, based on other primary records. These sheets, along with the later sheets for all production, are in Vol. 333, Scovill II.

³⁷ "Reports to General Superintendent and superseded lists," Case 34, Scovill II.

³⁸ 13 August 1918, E.H. Davis to R.S. Sperry, Case 34, Scovill II. Further quotes in this paragraph are from the same report.

³⁹ See, for example, 6 September 1893, J. Amory Haskell to G.F. Hamlin, and 7 September 1893, Haskell to H.S. Ely, Du Pont 500/II/2/#989, Book A8.

⁴⁰ See untitled and undated description of the activities of the Sales Record Division, Du Pont 500/II/3/#127. Quote that follows is from that description.

⁴¹ "Operating a High Explosives Plant," HEOD Superintendents' meeting #36, 1914, Du Pont 500/II/2/#585(?).

⁴² See, for example, summary nitrate of ammonia report, HEOD superintendents' meeting #33, 1911, Du Pont 500/II/2/#577.

⁴³ The H.E.O.D. Knocker, 28 January 1909, Hagley Museum and Library imprints collection.

⁴⁴ James B. Griffith, Correspondence and Filing, Instruction Paper, American School of Correspondence (Chicago, 1909), p. 7.

⁴⁵ Oscar Charles Gallagher and Leonard Bowdoin Moulton, Practical Business English (Boston: Houghton Mifflin Company, 1918), p. 184.

⁴⁶ Monagan to Bahney, 25 March 1918, Case 26, Scovill II.

⁴⁷ 5 March 1919, Henning to Dr. Bradshaw, Du Pont 500/II/2/#193/BD-41-E. The other memos in this series bear the same date and are in the same file.

⁴⁸ For a detailed exposition of the evolution of filing, see my "From Pressbook and Pigeonhole to Vertical Filing" and Control through Communication.

⁴⁹ A 1918 bibliography lists 28 books just on filing correspondence, and more on filing more specialized records such as forms and cards (Blanch Baird Shelp, Office Methods, Practical Bibliographies (NY: The H.W. Wilson Company, 1918.)

⁵⁰ Edward A. Cope, Filing Systems: Their Principles and Their Application to Modern Office Requirements (London and New York: Sir Isaac Pitman and Sons, Ltd., [1913], p. 14.

⁵¹ 26 December 1913, H.B. Riggs to Rubino, Vol. 558, Scovill I.

^{5 2} The changeover is announced to the New York store in a letter dated 27 December 1913, Vol. 558, Scovill I.

^{5 3} See the files in Case 26, Scovill II.

^{5 4} See files in Du Pont 500/II/2/#986.

^{5 5} 31 January 1914, Fin Sparre to Ballistic Division, Du Pont 500/II/2/#193/BD-41-A.

^{5 6} An announcement dated 1 June 1919, Du Pont 500/II/2/#345, established the new system. At this date the BD (Ballistics Division) files end.

^{5 7} The original purpose of the Hall of Records, as stated in Charles Copeland's, 11 April 1922 circular letter to all departments, LMss 10/418/#5.

^{5 8} David F. Noble, America by Design: Science, Technology, and the Rise of Corporate Capitalism (NY: Oxford University Press, 1977), p. 260.

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